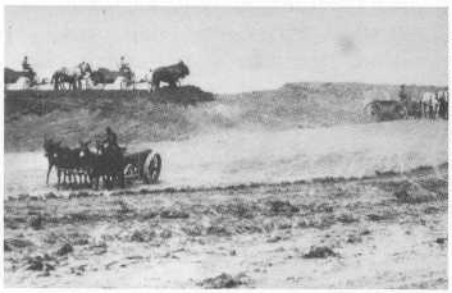
Flood Control



Public Affairs Office, Corps of Engineers

Early levee construction.

Fascine matting on a Mississippi River levee, 1885.

Public Affairs Office, Corps of Engineers

Congress did not authorize a comprehensive topographic and hydrographic study of a major river basin until 1850, when floods along the Mississippi River drew congressional attention to the need for a practical plan for flood control and navigation improvements at the river's mouth. The Secretary of War, Charles M. Conrad, sent Lieutenant Colonel Stephen H. Long and Captain Andrew A. Humphreys, two officers of the Corps of Topographical Engineers, to the Mississippi basin to conduct the survey. Charles S. Ellet, Jr., one of the best-known engineers of the day, also applied to make the delta survey. Conrad suggested that Ellet work with Long and Humphreys, but Ellet preferred to work independently. Under pressure from some congressmen and after seeing President Millard Fillmore, Conrad relented, dividing the $50,000 congressional appropriation between the Army survey and Ellet's.

Before the Army survey was complete, Humphreys became quite ill and had to quit. Long drafted a report based on Humphreys' notes, but he confined it simply to an exposition of what had been done without offering any specific recommendations. Therefore, Ellet's essay became the first comprehensive study of flood control on the Mississippi. Both reports were sent to Congress in January 1852. What distinguished Ellet's submission was the author's insistence on both the practicability and value of build-

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Flood refugees flee to the levees in Hickman, Kentucky, 1912.

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Shoring up a levee near Memphis, 1927.

ing reservoirs on the Mississippi's tributaries to reduce flooding. That recommendation prompted Colonel John J. Abert, Chief of the Corps of Topographical Engineers, to write, "While I willingly admit that all the speculations of a man of intellect are full of interest and deserving of careful thought, yet I cannot agree with him that these reservoirs would have any good or preventive effects upon the pernicious inundations of this river . . . ."

Nine years later Humphreys elevated Abert's comment to official Corps policy. After a long convalescence and subsequent work on western railroad surveys, Humphreys took up his task once more in 1857, this time with the assistance of Lieutenant Henry L. Abbot. Abbot supervised a party that took gauge readings, determined discharges at various points, measured cross-sections and reported on the state of various river improvements. When possible, he compared his data with that obtained by earlier survey parties. "In a word," Abbot later wrote, "the finger was to be firmly placed on the pulse of the great river, and every symptom of its annual paroxysm was to be noted." It was in the shadow of the Civil War that Humphreys and Abbot finally put their 500-page report together. They submitted it to the Chief of Topographical Engineers in August 1861, a few months after the firing on Fort Sumter. Humphreys was technically the report's author, but he insisted on listing Abbot as co-author in recognition of Abbot's diligence and skill.

Humphreys' and Abbot's *Report Upon the Physics and Hydraulics of the Mississippi River* not only contained much new data about the Mississippi, but also analyzed other alluvial rivers around the world. The authors introduced entirely new formulations to explain river flow and sediment resistance and concluded that Ellet's calculations and assumptions were erroneous. Their own position, based on significantly more information, was that "levees only" could prevent flooding on the Mississippi. Neither reservoirs nor cut-offs were needed. Already a member of the American Philosophical Society, Humphreys received numerous honors for his work on hydraulics. He was made an hono-

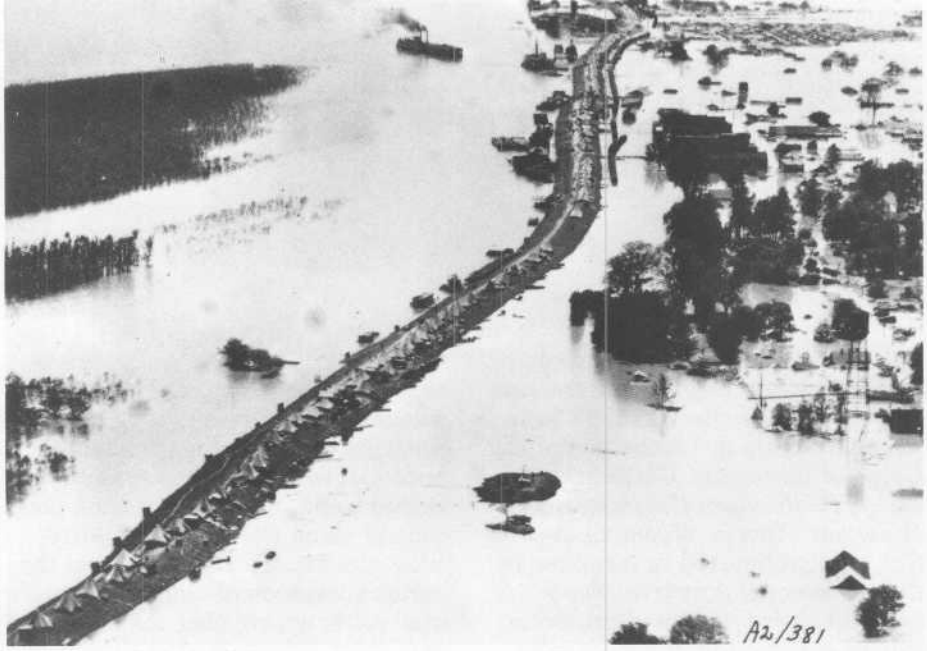
St. Louis District files, Corps of Engineers

Flood at Greenville, Mississippi, 1927.

The Corps of Engineers: Dam Destroyers?

On January 15, 1907, Major William Sibert, Pittsburgh district engineer, learned the depressing news that heavy flooding was undermining the abutment of Allegheny River Dam 3. If the dam continued to hold, which seemed likely, the flooding would gradually undermine the bank, thereby threatening a railroad track and a million dollar glass factory. Already nine homes, various outbuildings, and 5.3 acres of land had caved into the river. After long and undoubtedly agonizing discussion with his staff, Major Sibert made his decision: the dam would have to go. To allow the water to continue around the dam was to invite further catastrophe. The next morning blasting began. Five-hundred-pound dynamite charges were placed along the dam crest, and dynamiting continued until a 560-foot section at midstream had been removed. Then stones were placed along the bank to protect the glass factory and the railroad.

On January 30, the *New York Sun* printed an editorial which attacked the lack of progress on waterway projects. However, the editors noted, "no charge of dilatoriness can be brought against the officer who a few weeks ago saved a million dollars worth of property by assuming the responsibility of blowing up $80,000 worth of dam." Sibert became perhaps the only Corps officer ever commended by the Chief of Engineers for blowing up a government dam. His courage, imagination and ability to bend to circumstances set high standards for his successors at the Pittsburgh District Office.



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Flood victims of Arkansas City, Arkansas, camp on a levee, 1927.

rary member of the Imperial Royal Geological Institute of Vienna in 1862 and a fellow of the American Academy of Arts and Sciences in 1863. The following year he was elected an honorary member of the Royal Institute of Science and Arts of Lombardy, and in 1868 Harvard College conferred upon him the degree of Doctor of Laws.

In considering navigation and flood control as interrelated problems Humphreys, Abbot, Ellet and other engineers in the United States and many in Europe were ahead of their time. By 1879 growing pressures for navigation improvements and flood control prompted Congress to establish the Mississippi River Commission—a seven-member organization responsible for executing a comprehensive plan for flood control and navigation works on the lower Mississippi. This permanent body of experts included three members from the Corps of Engineers, one from the Coast and Geodetic Survey, and three civilians, two of whom had to be civil engineers. The creation of this river basin authority marked the federal government's growing commitment to the development of a reliable inland waterway system. Initially, Congress authorized the commission to build and repair levees only

Vicksburg District files, Corps of Engineers

High water at Pine Bluff, Arkansas, 1927.

The Bicycle Flood Fight, 1897

The Fourth Engineer District at New Orleans received word in early 1897 that a major flood was southbound on the Mississippi. Major George M. Derby, district engineer, and civilian assistant W. J. Hardee prepared to defend the levees along more than 450 miles of river in the Fourth District. As had become customary by 1897, they stationed barges and quarterboats loaded with tools, sandbags and lumber at roughly 15-mile intervals along the river with towboats assigned to each 60-mile section.

During previous flood emergencies, Fourth District personnel had encountered great difficulty maintaining regular patrols of the levee system and coordinating the work of five other agencies: individual planters, railroads, parish governments, levee districts and state government. Backwater and washouts had closed roads and railroads; there then were no motorized vehicles available, and the towboats moved too slowly and usually too far from the levees for proper inspection. In order to improve coordination and inspection, Hardee equipped field personnel with bicycles, and during the subsequent flood fight the inspectors kept constantly on the move atop the levee crowns on their new transportation equipment. Hardee personally covered as much as 30 miles of levee a day on his bike, including stops for observation (and presumably to catch his breath).

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Carbide lamps illuminate sandbagging operations on Mississippi ring levee, 1944.

if the work was part of a general navigation improvement plan. Monumental floods in 1912 and 1913, however, drew national attention to the need for federal flood relief legislation. Finally, in 1917 Congress passed the first flood control act. This legislation appropriated $45 million for flood control on the lower Mississippi and $5.6 million for work on the Sacramento River.

The report of Humphreys and Abbot enormously influenced river engineering in the United States. Until 1927, when a catastrophic flood hit the lower Mississippi, the Corps' position was that "levees only" could control flooding on the river. The Corps was not unalterably opposed to reservoirs. Several were built on the upper Mississippi, but principally to aid navigation. Advocates of reservoir construction also received support in 1897 from Captain Hiram S. Chittenden of the Corps of Engineers. Chittenden's essay, *Preliminary Examination of Reservoir Sites in Wyoming and Colorado*, submitted in response to a congressional directive, was a comprehensive and lucid presentation of engineering, physiographic and economic data. In it Chittenden declared that reservoir construction in the arid regions of the West was "an indispensable condition to the highest development of that section." He also warned, "The function of reservoirs will always be primarily the promotion of industrial ends; secondarily only, a possible amelioration of flood conditions in the rivers." So far as the Mississippi was concerned, "the difficulty was not so much a physical as a financial one." He identified a few potential reservoir sites in the Mississippi basin, but thought that flood control alone would never justify construction. He also examined the various methods of constructing reservoirs, noting that the arched dam, first constructed in France in the 1860s, showed promise for use in the West. Finally Chittenden boldly proposed that public agencies, mainly federal, be charged with the responsibility for reservoir development.

Public Affairs Office, Corps of Engineers

Floodwater over Bonnet Carré spillway.

With the passage of the second major flood control act in 1928, the federal government became firmly committed to flood control on the Mississippi. This act resulted from the public response to the flooding the year before, which had taken between 250 and 500 lives in the lower Mississippi basin, had flooded more than 16 million acres and had left over half a million people requiring temporary shelter. Two reports were submitted to Congress recommending ways to prevent future disasters of this magnitude, one by the Mississippi River Commission and the other by the Chief of Engineers, Major General Edgar Jadwin. Principally because Jadwin promised equal protection for less than half the money, Congress accepted his plan. This time there was no dispute about levees. The 1927 flood demonstrated the bankruptcy of the "levees only" policy. In addition to levees, Jadwin proposed a mix of floodways and spillways, including the much discussed Bonnet Carré spillway connecting the Mississippi with Lake Pontchartrain. Also included in the plan was the controversial idea of sending about half of the Mississippi's flood waters down the Atchafalaya River into the Gulf of Mexico. This was an idea which Humphreys and Abbot had deemed

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Sandbagging.

"virtually impracticable," but the Atchafalaya had greatly enlarged over the years so that most engineers now considered the proposal workable. On the other hand, Jadwin stood firmly in the tradition of his predecessor in his opposition to reservoirs. He had established a special Reservoir Board of engineer officers to examine the subject and the board had concluded that Jadwin's plan was "far cheaper than any method the board has been able to devise for accomplishing the same result by any combination of reservoirs."

Nevertheless, the idea of locating reservoirs on the lower Mississippi was far from dead. In fact, the Corps' own work stimulated interest in the subject. In 1927 Congress authorized the Corps to survey the country's navigable streams in order to formulate plans for the improvement of navigation, water power, flood control, and irrigation. The surveys came to be called "308 reports," named after Congressional Document 308 in which the Corps and the Federal Power Commission had jointly presented to Congress the estimated cost for the reports. Soon after funds were appropriated, Corps district offices around the country proceeded with the surveys. Having dispensed with the main stem of the Mississippi in the Jadwin plan, district engineers along the lower Mississippi directed their attention to the major tributaries. Not surprisingly, they concluded that construction of reservoirs along such streams as the Yazoo and St. Francis, while contributing to local flood control, would not be cost effective. This position proved increasingly politically unpopular in the midst of growing unemployment resulting from the Great Depression. Public works projects, once considered uneconomical, began looking very attractive as a means of employment. Moreover, many politicians felt that flood control was essential to protect human life no matter what the economists said. Mainly reacting to this political interest, the Corps reversed its position on a number of flood control projects. Revised reports concluded that the necessity for "public-work relief" and the suffering caused by recurring floods provided grounds for construction.

The 1936 Flood Control Act recognized that flood control was "a proper activity of the Federal Government in cooperation with States, their political subdivisions, and localities thereof." Responsibility for federal flood control projects was given to the Corps of Engineers, while projects dealing with watershed run-off and soil erosion were assigned to the Department of Agriculture. This law made the Corps responsible for flood control throughout the nation, working in cooperation with the Bureau of Reclamation. In the years following passage of this law, the Corps built, pursuant to congressional authorization and appropriation, some 300-400 reservoirs whose primary benefit was flood control. However, it is inconceivable that these reservoirs would have been built had flood control been the only benefit. In the age of multipurpose projects, possible navigation, water storage, irrigation, power and recreation benefits were considered before a final economic benefit figure was determined.

The Benefits of Military Training: Colonel Eugene Reybold and the 1937 Flood

During the 1937 floods on the Ohio and Mississippi Rivers, Lt. Col. Eugene Reybold, district engineer at Memphis, used his military expertise to combat the record high waters. Reybold's district embraced the Mississippi and its tributaries from Cairo, Illinois, to the mouth of the Arkansas River. In January, rain equal to half the normal annual precipitation fell on the Ohio Valley, causing record floods at every point on the Ohio River and sending raging waters rushing down the Mississippi. The ground was frozen and the runoff rapid. The waters threatened Cairo and the valley below.

Reybold drew upon his training at the Command and General Staff School and the War College to deal with the situation. He wrote an estimate of the emergency and organized a defensive position against the unpredictable and treacherous enemy. He called upon the St. Louis and Kansas City districts for boats equipped with radios and drew experienced flood fighters from all districts. The commanding general of the 4th Corps Area in Atlanta supplemented the floating radio network with Army Signal Corps units equipped with field radios and telephones. Reybold had communications available for practically every mile of main levee in his district. Finally, he set up Red Cross Headquarters in Memphis to take care of the anticipated flood refugees.

From his command post in the district office in Memphis, Reybold directed his forces against the approaching enemy. There were many dark moments, but Reybold promptly learned of each and every weakness in the levees and quickly had them reinforced. "My military training," he later observed, "and similar training of countless engineer officers sent to my assistance had a lot to do with the safe passage of the greatest flood the lower Mississippi Valley ever experienced."